

~~1~~ 12. A method for forming a film, the method comprising sputtering a target,

wherein

the sputtering target comprises a substrate and a target material formed on the substrate;

the target material comprises as the main component an oxygen deficient oxide;

the oxygen deficient oxide comprises a metal oxide of a chemical formula TiO_x that is deficient in oxygen as compared with a stoichiometric composition of the metal oxide; and

$1 < x < 2$.

~~2~~ 13. The method according to Claim ~~12~~, wherein the sputtering is DC sputtering.

~~3~~ 14. The method according to Claim ~~12~~, wherein the target has a resistivity of at most $10 \Omega cm$.

~~4~~ 15. The method according to Claim ~~12~~, wherein the target has a resistivity of at most $1 \Omega cm$.

~~5~~ 16. The method according to Claim ~~12~~, wherein the target further comprises an oxide of at least one metal selected from the group consisting of Cr, Ce, Y, Si, Al and B.

~~6~~ 17. The method according to Claim ~~16~~, wherein the target contains the oxide of at least one metal in an amount of at most 20 wt%.

~~7~~ 18. The method according to Claim ~~12~~, wherein the sputtering is carried out in an argon atmosphere or in a mixed atmosphere of argon and oxygen.

~~8~~ 19. The method according to Claim ~~18~~, wherein the mixed atmosphere of argon and oxygen comprises at most 30 vol% oxygen.

~~9~~ 20. The method according to Claim ~~12~~, further comprising forming a film having a refractive index of 2.4.

B1 CMX
10/21. A sputtering target comprising

a substrate;

a target material formed on the substrate; and

an undercoat of a metal or alloy between the target material and the substrate, wherein

the target material comprises as the main component an oxygen deficient oxide;

the oxygen deficient oxide comprises a metal oxide of a chemical formula TiO_x that is

deficient in oxygen as compared with a stoichiometric composition of the metal oxide; and

$1 < x < 2.$

11/22. The sputtering target according to Claim 21, wherein the undercoat has a thermal

expansion coefficient between a thermal expansion coefficient of the target material and a

thermal expansion coefficient of the substrate.

13/23. The sputtering target according to Claim 21, wherein the undercoat comprises

a first layer, which is adjacent to the substrate and which has a thermal expansion coefficient between the thermal expansion coefficient of the target material and the thermal expansion coefficient of the substrate; and

a second layer, which is adjacent to the target material and which has a thermal expansion coefficient within a range of $\pm 2 \times 10^{-6}/^{\circ}C$ of a thermal expansion coefficient of the target material.

14/24. The sputtering target according to Claim 21, wherein the undercoat comprises a

material selected from the group consisting of Mo, Ti, Ni, Nb, Ta, W, Ni-Al, Ni-Cr,

Ni-Cr-Al, Ni-Cr-Al-Y and Ni-Co-Cr-Al-Y.

15/25. The sputtering target according to 21, wherein the undercoat has a thickness of

from 30 to 100 μm .

12/26. The sputtering target according to Claim 22, wherein the thermal expansion

coefficient of the undercoat is from 12×10^{-6} to $15 \times 10^{-6}/^{\circ}C$.

B1 *Sub C2* 14 21. The sputtering target according to Claim 21, wherein the undercoat has a thermal expansion coefficient within a range of $\pm 2 \times 10^{-6}/^{\circ}\text{C}$ of a thermal expansion coefficient of the target material. *16*

B1 *Sub C2* 17 28. The sputtering target according to Claim 21, wherein the thermal expansion coefficient of the undercoat is from 4×10^{-6} to $11 \times 10^{-6}/^{\circ}\text{C}$. *16*

B1 *Sub C2* 29. The sputtering target according to Claim 21, wherein the target material has a thickness of from 2 to 10 nm. *10*

B1 *Sub C2* 19 30. The sputtering target according to Claim 21, wherein the target has a resistivity of at most $10 \Omega\text{cm}$. *10*

B1 *Sub C2* 20 31. The sputtering target according to Claim 21, wherein the target has a resistivity of at most $1 \Omega\text{cm}$. *10*

B1 *Sub C2* 21 32. The sputtering target according to Claim 21, wherein the target material further comprises an oxide of at least one metal selected from the group consisting of Cr, Ce, Y, Si, Al and B. *21*

B1 *Sub C2* 22 33. The sputtering target according to Claim 32, wherein the oxide of at least one metal is contained in an amount of at most 20 wt %. *21*

B1 *Sub C2* 23 34. A method of making a sputtering target, the method comprising providing an undercoat on a substrate;

depositing a target material on the undercoat; and

B1 *Sub C2* 24 forming the sputtering target of Claim 21. *10*

B1 *Sub C2* 25 35. The method of Claim 34, wherein the depositing comprises plasma spraying. *23*

B1 *Sub C2* 26 36. A method of using a sputtering target, the method comprising sputtering the sputtering target of Claim 21-- *10*